

초장축 고속선의 추진축계 배치에 관한 연구

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A study on the shaft alignment concerning long shaft for high speed vessel

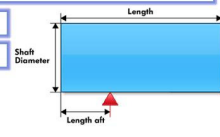
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Abstract : Proper shaft alignment is one of the most important actions during the design of the propulsion system. The stiffness of recently designed marine propulsion shafting has been increasing remarkably, whereas hull structures have become more likely to deform as a result of optimized design of the scantlings and the high tensile steel. Therefore, to obtain the optimum status in shafting alignment at the design stage, it is strongly recommended that the change of bearing reaction force depending on ballast/load condition, the bending moment force occurred by propeller thrust, elastic deformation of bearing occurred by vertical load of shaft mass and etc., should be considered. This paper dealing with introduction of shaft alignment concerning long shaft for high speed vessel and review its reliability evaluation theoretically.

Key words : Shaft alignment, Long shaft, CPP, Reduction gear

Definitions and assumptions

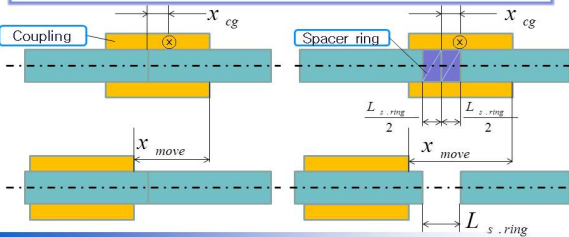
- ◆ Reference point : Aft end of propeller
- ◆ Reference line : The straight line through no. 1, 2 & 3
- ◆ Bearing support point : 0.5*∅ aft end (cold condition) (S/T bearing) 0.5*∅ fwd end (MCR condition)
- ◆ Bearing support point : Mid point for all other bearings
- ◆ Buoyancy effect : The shaft parts in water is considered
- ◆ Bearing clearance aft stern tube : 1.7 mm (Aft S/T bearing)
- ◆ Hot condition : 70°C at MCR Speed
- ◆ Cold condition : 20°C static



Shaft alignment concerning long shaft for high speed vessel

SKF Coupling (위치의 이동)

◆ 고정된 플랜지와는 상이하게 SKF coupling은
- 체결시와 해체시 SKF coupling의 위치가 달라진다.
- SKF의 무게중심의 이동에 따라 축계의 계산 결과값이 달라진다.
- Gap/Sag 및 Jack-up 계측시 이를 적절히 반영하여야 한다.



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Reduction gear box (온도, 기어하중, 굽힘모멘트 Mx)

Displacement of gears shafts of full load end at 5K	Displacement by bearing clearance (mm)	Displacement by thermal expansion (mm)	100% MCR (mm)
Output shaft	horizontal Δh	vertical Δh	horizontal Δh
Input shaft	horizontal Δh	vertical Δh	horizontal Δh
PTO shaft 1	horizontal Δh	vertical Δh	horizontal Δh
PTO shaft 2	horizontal Δh	vertical Δh	horizontal Δh

Assumption: Operating temp. 70°C alignment temp. 20°C

Input speed: 1350 1/min
Input power: 4400 kW
Engine sense of rotation: counterclockwise
Propeller sense of rotation: counterclockwise
Ratio: 4.957

Pos#	Shaft segment (mm)	Shaft diameter (mm)	X=001 (mm)	X=002 (mm)	G(N) (N/m)
1	10.00	250.00	95.00	10.00	3.45
2	49.00	230.00	90.00	70.00	42.00
3	236.00	279.80	95.00	311.00	193.00
4	92.00	280.00	90.00	260.00	197.00
5	52.00	240.00	95.00	415.00	189.00
6	130.00	111.87	96.00	579.00	514.00
7	130.00	111.87	96.00	739.00	544.00
8	11.00	250.00	96.00	747.00	16.79
9	45.00	230.00	96.00	812.00	19.87
10	45.00	230.00	96.00	857.00	19.87
11	132.00	290.00	96.00	1055.00	989.00
12	40.00	290.00	112.00	1095.00	1570.00
13	93.00	290.00	135.00	1169.00	1126.00
14	10.00	290.00	140.00	1279.00	1173.00

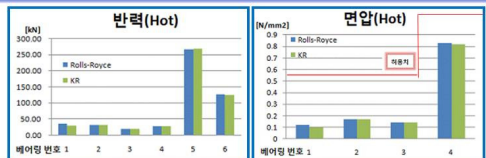
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Comparison

◆ SeaTrust-SHALI ver 2.1을 이용, 선박의 정지 및 운전상태에서의 축계정렬, 캡색 및 작업 계산을 수행함.

◆ 베어링의 하중, 및 영향계수를 분석하고, Reduction gear의 열팽창 효과를 고려하여 축계정렬이 이론적으로 최적이 되는 방안을 모색함.

◆ 비교결과, 가장 축독한 조건인 정지상태(Static)에서와 운전상태(MCR)에서의 값이 매우 유사하였다.



참고문헌

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